

4.12 PALEONTOLOGICAL RESOURCES

Paleontological resources represent a limited, nonrenewable, and impact-sensitive scientific and educational resource. As defined in this section, paleontological resources (i.e., fossils) are the remains and/or traces of prehistoric plant and animal life exclusive of man. Fossil remains such as bones, teeth, shells, and leaves are found in the geologic deposits (rock formations) where they were originally buried. Paleontological resources include not only the actual fossil remains, but also the collecting localities and the geologic formations containing those localities. This section identifies geologic formations within Carlsbad, as well as the potential for those formations to contain fossil remains. The information contained in this section is derived from information found in geologic formation mapping and paleontological reports.

4.12.1 Existing Conditions

4.12.1.1 Program Level

A wide range of geologic rock formations occur throughout Carlsbad, with varying degrees of sensitivity for paleontological resources. The following discussion addresses those rock formations found within the city that are considered moderately to highly sensitive for paleontological resources. A report describing the paleontological resources in Carlsbad and a paleontological resources reference map are available at the City Planning Department.

Unnamed Marine Terrace Deposits

The Coastal Plain Province of San Diego County is characterized by a “stair-step” sequence of elevated marine terraces (uplifted sea floors) and associated marine and nonmarine sedimentary covers (Deméré and Walsh 1993). The unnamed marine terrace deposits often consist of a basal nearshore marine stratigraphic unit and an upper nonmarine stratigraphic unit. The basal unit has produced large and diverse assemblages of marine invertebrate fossils such as mollusks, crustaceans, and echinoids as well as sparse remains of marine vertebrates such as sharks, rays, and bony fish. The upper unit has produced sparse remains of terrestrial mammals such as camel, horse, and mammoth. Based on the sedimentary origin of these deposits and the published fossil record, they have been assigned moderate paleontological resource sensitivity.

Unnamed River Terrace Deposits

Deposits of coarse-grained, gravelly sandstones; pebble and cobble conglomerates; and claystones occur along the margins of many of the larger coastal valleys. The exact age of the deposits is uncertain, but they are related to the Pleistocene climatic events (Deméré and Walsh 1993). Although limited fossil occurrence has resulted from these deposits, remains of “Ice Age” mammals and other important vertebrate remains have been collected from several sites, indicating the potential for significant paleontological resources elsewhere. Thus, a moderate resources sensitivity has been assigned.

Santiago Formation

Middle Eocene strata in northwestern San Diego County have been generally assigned to the Santiago Formation, with three members (“A,” “B,” and “C”) recognized in the Encinitas-Carlsbad area. Member “B” of the Santiago Formation has produced well-preserved vertebrate fossils, from several localities in Carlsbad and Oceanside, including remains of opossums, insectivores, primates, rodents, brontotheres, rhinoceros, and uintathere (Deméré and Walsh 1993). The mammalian fauna is especially significant as it contains a mosaic of archaic and advanced species, and serves to document an important period in mammal evolutionary history. Member “B” of the Santiago Formation is assigned a high paleontological resource sensitivity based on the recovery of important remains of terrestrial vertebrate fossils.

Delmar Formation

The Delmar Formation was deposited in lagoonal/estuarine settings during the middle Eocene (Kennedy and Tan 1966). Fossils from the Delmar Formation consist of well-preserved to poorly preserved remains of estuarine invertebrates such as clams, oysters, and snails, as well as estuarine vertebrates, such as sharks and rays. This formation is considered highly sensitive for paleontological resources due to the important remains of terrestrial vertebrate fossils it has produced (Deméré and Walsh 1993).

Point Loma Formation

The Point Loma Formation was deposited on an ancient sea floor during the late Cretaceous and has produced many well-preserved types of fossil marine invertebrates, such as clams, snails, nautiloids, ammonites, crabs, and sea urchins, as well as marine vertebrates, such as sharks and mosasaurs (Deméré and Walsh 1993). The formation has also produced some remains of

terrestrial plants and armored and duck-billed dinosaurs. As a result of the diverse and well-preserved marine fossils and dinosaur remains produced by the Delmar Formation, it has been assigned a high paleontological sensitivity.

Lusardi Formation

The Lusardi Formation consists of reddish-brown, poorly sorted, sandy pebble and boulder conglomerates with minor lenses of arkosic sandstone (Deméré and Walsh 1993). Although no identifiable fossils have been recovered from the Lusardi Formation, it has been assigned a moderate paleontological sensitivity due to its unproven resource potential.

Undifferentiated Santiago Peak Volcanics

Santiago Peak Volcanics are composed primarily of volcanic breccias, with a lesser amount of volcanic tuffs and flows (Deméré and Walsh 1993). The earliest flow-rocks date back to the Cretaceous ages. While the molten origin of the formation generally precludes the possibility of fossil remains, medisedimentary portions of the formation have produced important remains of siliceous microfossils and marine macroinvertebrates, including belemnites and clams. Therefore, the medisedimentary rocks of the Santiago Peak Volcanics have been assigned a high paleontological resources sensitivity, while the remainder of the formation is considered to have marginal sensitivity.

4.12.1.2 Project Level

The project area for components B and BN is located on Quaternary Alluvium, which has been assigned a low paleontological resource sensitivity due to the relatively young age (i.e., generally younger than 10,000 years) of the deposits (Deméré and Walsh 1993).

4.12.2 Significance Criteria

The DMP Update would result in potentially significant impacts to paleontological resources if it would:

- directly or indirectly destroy an identified sensitive paleontological resource or site or an identified sensitive geologic feature.

4.12.3 Impact Analysis

4.12.3.1 Program Level

Proposed DMP Update components may require excavation activities within potential fossil-bearing geologic formations (as identified in Section 4.12.1.1 above), which would be determined during project-specific design. Excavation in such formations could potentially impact significant paleontological resources, particularly within formations considered moderately to highly sensitive for paleontological resources. Project-specific information regarding underlying formations would become available during project design (i.e., through geotechnical analysis required in Table 3-6) prior to grading. Proposed DMP Update project components that involve repairs and/or maintenance of existing facilities would not result in additional impacts to paleontological resources. These areas and associated underlying earth materials have previously been disturbed during construction.

While construction of proposed DMP Update components may disturb fossil-bearing geological strata in many locations throughout the city, many proposed components would occur in areas previously disturbed or would be limited to surface disturbance, however, and would not require excavation into intact geological formations. For example, pipelines would generally be constructed in road rights-of-way or existing easements where strata have already been disturbed, so the recovery of intact fossil remains representing unique paleontological information is highly unlikely. Therefore, construction of DMP Update components would result in potentially significant impacts to paleontological resources.

4.12.3.2 Operation and Maintenance

Proposed operation and maintenance activities would primarily involve replacement of, or modifications to, existing drainage facilities located in previously disturbed areas and would not result in additional disturbance to paleontological resources or sites or unique geologic features. Therefore, disturbance of unique paleontological resources or sites or unique geologic features is not anticipated during operation and maintenance activities. Potential impacts would be less than significant.

4.12.3.3 Project Level

The proposed project boundary for project level DMP Update components B and BN is located on Quaternary alluvial deposits, which have a low to moderate potential to contain

paleontological resources (Deméré and Walsh 1993). Additionally, the creeks were previously dredged and channelized during construction of the Rancho Carlsbad residential community in the late 1960s, as well as during the emergency dredging conducted in March 2006. Dredging activities are intended to excavate material to the original grades in the creeks (to a depth of 4 to 6 feet), only remove debris and sediment that have accumulated in the last few decades, and not extend into previously undisturbed intact geological formations. Therefore, unique paleontological resources or sites or unique geologic features would not likely be destroyed as a result of conducting the proposed dredging and improvements. Potential impacts to paleontological resources are considered less than significant.

Further, long-term maintenance of the creeks would be conducted in disturbed areas where dredging and channel improvement have previously occurred and would remove accumulated debris and sediment. Because activities would remove only accumulated debris and sediment, and proposed removal would not extend into previously undisturbed intact geological formations, destruction of unique paleontological resources or sites or unique geologic features is not anticipated as a result of conducting long-term maintenance in the creeks. Potential impacts to paleontological resources are considered less than significant.

4.12.4 Significance of Impacts

4.12.4.1 Program Level

For DMP Update components proposed in locations considered to have moderate to high sensitivity for paleontological resources (to be determined during project-specific design), grading and earthwork could disturb potentially unknown fossil remains and the information in the fossils could be lost. Impacts would be considered significant. (Paleo-1)

4.12.4.2 Project Level

No direct or indirect significant impacts to paleontological resources are anticipated to occur from proposed project level DMP Update components.

4.12.4.3 Operation and Maintenance

No direct or indirect significant impacts to paleontological resources are anticipated to occur from proposed operation and maintenance activities.

4.12.5 Mitigation Measures

4.12.5.1 Program Level

The following mitigation measures shall be implemented during construction of PLDA and non-PLDA project components proposed in geologic formations with a moderate to high sensitivity for paleontological resources, including Unnamed Marine Terrace Deposits, Unnamed River Terrace Deposits, Santiago Formation, Del Mar Formation, Point Loma Formation, Lusardi Formation, or Undifferentiated Santiago Peak Volcanics. Determination of the underlying geologic formations shall be determined during project design through existing mapping, project-specific geotechnical investigations, or other appropriate testing methods. Implementation of these measures will reduce impacts to paleontological resources to below a level of significance.

Paleo-1 A monitoring program shall be prepared and implemented if excavation into intact geologic formations with moderate to high sensitivity is proposed. Components of such a monitoring program shall include, but not be limited to, the following:

- a) A qualified paleontological monitor shall be present at a pregrading meeting with the construction contractor and PD of the City Planning Department. The purpose of the meeting will be to consult and coordinate the role of the paleontologist during construction. The paleontological monitor shall have adequate knowledge and experience with fossilized remains likely to be present to identify them in the field. The paleontological monitor shall be adequately experienced to remove paleontological resources for further study.
- b) The paleontological monitor shall be present during the applicable stages of grading and construction (including trenching), as determined at the pregrading meeting. The paleontological monitor shall have the authority to temporarily direct, divert, or halt grading in the area of an exposed fossil to facilitate evaluation and, if necessary, salvage. At the discretion of the monitor, recovery may include washing and picking of soil samples for microvertebrate bone and teeth. Construction activities in the area of discovery shall resume upon notification by the paleontologist that fossil remains have been recovered. The City shall ensure the contractor is aware of the random nature of fossil occurrences and the possibility of a discovery

of such scientific and/or educational importance that it might warrant a long-term salvage operation or preservation. All fossils collected shall be donated to a museum with a systematic paleontological collection, such as the San Diego Natural History Museum. The City shall ensure the grading contractor is aware of this provision. Conflicts regarding the role and authority of the monitor shall be resolved by the PD or his/her designee.

- c) Collected fossils shall be cleaned and/or prepared to a point of identification, and then curated to museum standards (cataloging of locality and specimen data, numbering, identification, labeling) before being deposited in an appropriate public facility (or facilities) that can provide permanent archival storage (so that specimens are available for future scientific study). A report detailing the mitigation and any discoveries shall be prepared and submitted to the City within 3 months following termination of the paleontological monitoring program, even if negative. The report shall include necessary maps, graphics, and fossil lists to adequately document the paleontological monitoring program.

4.12.5.2 Operation and Maintenance

No direct or indirect impacts to paleontological resources are anticipated to occur during operation and maintenance activities; therefore, mitigation would not be required.

4.12.5.3 Project Level

No direct or indirect impacts to paleontological resources are anticipated to occur as a result of project level DMP Update components; therefore, mitigation would not be required.

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